Report for 2004GU50B: Qualitative examination of groundwater from Yap and some of its neighboring islands

There are no reported publications resulting from this project.

Report Follows

Project Title
Qualitative examination of groundwater from Yap and some of its neighboring islands

Problem and Research Objectives
Yap receives over 100 inches of rain annually and much of the rainwater seep into the ground. The groundwater provides drinking water for about half of the Yap population. Yet, no scientific data is currently available on the quality of water sources. No qualitative examination of groundwater samples has ever conducted owing to the economic and other infrastructure constraints of Yap State Public Service Corporation (YSPSC), the establishment responsible for water treatment and distribution. Consequently, groundwater contamination caused by pathogen or chemicals remains undetected. Current treatment facility at Colonia (Central Water System) is able to supply nearly 500,000 gallons of treated water daily for a population of about 3500. Declining Compact Grants from United States in recent years and lack of necessary infrastructure facilities and trained work force makes it difficult for YSPSC or Yap State Environmental Protection Agency (EPA) to conduct periodic monitoring of water sources. The limited number of water reservoirs in the State that exist close to the human habitation makes it a very likely source of contamination and thereby water borne diseases.

On Yap, potential sources of groundwater pollution include human and animal feces, leachate from garbage dump, abandoned motor vehicles and corroded World War relic armaments lying all around the island. According to Yap State Census Report, 76 percent of the population does not have proper toilet facilities whereas in its neighboring islands 96 percent of the population relies on 'other means' of waste disposal. Recent tests on groundwater from Southern Water System showed elevated levels of nitrate. Similarly there are reports of polluted groundwater lens in Ulithi. Here, island inhabitants use open toilets resulting that the available groundwater lens is heavily contaminated with fecal coliform bacteria. These information calls for immediate intervention and thorough examination of the groundwater sources to come up with necessary mitigation strategies.

Therefore, our objectives in this study are to (i) conduct a quality assessment of groundwater samples collected from different localities of Yap State including three of its main inhabited neighboring islands (ii) establish baseline information on the present conditions of the vital resource, and (iii) train YSPSC and Yap State EPA personnel in carrying out various water qualities testing procedures.

Methodology
Set of portable equipments coupled with commercially available test kits and laboratory exercise are mainly used to analyze water samples for microbiological and chemical qualities. Colilert and Enterolert reagents from Idexx are being used for the identification of coliforms, *E.coli* and Enterococci. An advanced portable laboratory test kit from Hac (CEL/890 Advanced Portable Laboratory) is being used to carry out basic tests such turbidity, hardness, pH, alkalinity, nitrate, sulfate, phosphate, potassium etc. Service of Intertek Laboratory (Manila) is being sought to analyze inorganic constituents and disinfection by- products.

A total of five sampling sites (from Yap proper and neighboring islands, Falalop-Ulithi and Woleai) are selected based on various source waters (groundwater wells, surface waters, rain catchments i.e.), on the recognized utilities providing water to consumers (Yap State Public Service Corporation, Southern Yap Water System, Gagi-Tomil Water System, and waters that have been treated with chemicals (YSPSC).

Principal Findings and Significance

As part of the capacity building component of the project, two staffs from Yap State Public Service Corporation and Yap State Environmental Protection Agency received one week training at WERI on various testing procedures.

Tim Scheidt, has been carrying out series of workshops on water sampling, testing, reporting and documentation. Employees of YSPSC Water Division, Yap State EPA, Yap State Health Services, Gagil-Tomil Water System (GTWS), Southern Yap Water System (SYWS) is attending this seven week long lecture cum hands on. During first week of this education series, lecture and discussion on sampling coliform bacteria conducted. Each participant was provided with a copy of the skill package written for this activity. In addition, each received a copy of the exercise "pre job planning" to assist in preparation of field activity. A brief overview of YSPSC Water Distribution System, including all source waters, was presented, and the class used the map of the system to determine the appropriate sampling sites. The class then discussed proper sample collection techniques, and proper documentation procedures, before collection and analysis at Yap State EPA laboratory.

Three distribution system samples were positive for Coliform, but not for *E.coli*. Repeat samples were taken on the following week to continue testing. Further, the group met at GTWS Office and reviewed the map of the GTWS system, identified sampling sites. Here, a total 29 samples were collected from source to various distribution points. Twenty eight out of 29 samples tested positive for coliform bacteria. A majority of those samples were positive for *E.coli*, including the source water (well#2), and the storage tank. One sample was negative for bacteria. The class then discussed the meaning of these results as they applied to the public health. The 'Public Notification' section of the skill package was reviewed, including the representative notice form provided. The group then devised a plan of action to correct the problem. It was determined that the GTWS Operator would inform the board of directors immediately of these findings, and to present the suggested plan of action to address the matter. A brief summary of the proposed plan taken is as follows:

1. Inform the general public according to the procedures outlined in the skill package.
2. Shut down #2 well. Run the other three wells a bit longer each day to compensate
3. Disinfect the well according to proper well disinfection procedures.
4. Drain, clean, inspect and disinfect the storage tank.
5. Flush the system with chlorinated water.
6. Resample the system.

Yap State EPA has assigned to assist GTWS with resampling and further discussion with the Board of Directors regarding the situation. The Board of Directors of the GTWS has responded favorably to the group's recommendations, and is directing the operations staff to commence with the recommended activities. The Yap State has also been instrumental in this effort by providing the additional sampling and analysis. The system has been flushed, and the storage tank is scheduled for draining, cleaning, inspection, and repair.

On a following week course, the group discussed the methods of reporting principal findings to the public and the specifics associated with that. The group reviewed example of a "Consumer Confidence Report" from a typical water service provider in the US, and considered creating one for each of the public water supplies on Yap.

Similar exercise on sampling, analysis and discussion is currently underway for other sampling sites including neighboring islands.